

ENVIRONMENT PROTECTION BOARD

BUILDING A GAS PIPELINE THROUGH THE ARCTIC

What About the Vegetation?

Rec'd: 24 May 1984
Order No. 1
Price: Gift
Acc. No. 1 Stan Thomson

BOREAL INSTITUTE
LIBRARY

56888

The Role of Vegetation

Vegetation is used to characterize and delimit northern ecosystems along the proposed pipeline route. Knowledge of the kinds of plants and their distribution in a region is a necessary part of the basic inventory of the natural environment. Each plant species has its own requirements of light, moisture, temperature and mineral nutrients. Groups of species having similar requirements grow together in plant communities. Thus, communities — their abundance, distribution and interrelationships — integrate environmental variables and provide an important key for understanding soils, drainage characteristics, and microclimate.

Plants are the food source for all animals, either directly or indirectly, and provide habitat for most animal species. Thus the plant communities in a region influence which animals will be found there.

Different types of plant communities have different degrees of susceptibility to fire. Tree or shrub dominated communities are very susceptible because they have a large combustible biomass and grow on relatively dry sites. Grass dominated communities are less susceptible to fire because they have less biomass and usually grow on moister sites. Because fire is a natural part of northern ecosystems, a knowledge of its frequency and role is necessary to understand the observed pattern of vegetation.

Vegetation reduces erosion and helps maintain slope stability. In the North, it also provides insulation for underlying permafrost and thereby controls the thermal balance of the ground surface. Removal of vegetation, especially the insulating surface layer of moss and peat, increases the heat flux to the ground. This can lead to thermokarst subsidence, erosion, and mass-wasting, especially of ice-rich soils. Studies of natural and man-made disturbances have provided information on the sensitivity of plant communities to disturbance and on how long it takes for plants to recolonize disturbed sites. This information allows us to predict the possible effects of the proposed pipeline project on terrain and vegetation.

Some Factors Limiting Plant Growth in the North

The growth of plants in the north is limited by several factors, including wind, precipitation, temperature, and permafrost. Of these, winds and permafrost are the major ones.

Winter winds play a major role by limiting the distribution of trees and shrubs. Winds drive snow and ice crystals against exposed overwintering buds on twigs and branches,

abrading, drying, and eventually killing them. As a result, trees are sculpted into odd shapes



H. Hernandez

and tundra shrubs are prevented from growing above the surrounding microtopography and snow cover. Thus, in regions of strong winter winds, trees and shrubs are limited to sheltered or snow-protected sites. Grasses, sedges and herbs that die back to ground level each winter are not damaged by wind.

Permafrost plays a dual role. It is beneficial in that it offsets an otherwise desert climate of low precipitation by restricting downward drainage in most soils. Summer thaw of the active layer provides enough water that drought is seldom a factor limiting plant growth. But permafrost also limits growth by keeping soil temperatures low. These lower temperatures restrict soil development and inhibit the activity of soil micro-organisms required to release nutrients necessary for plant growth.

These environmental factors, because they limit the various types of plant growth form (trees, shrubs, herbs), ultimately determine the extent of each vegetation zone in the north.

Vegetation Zones Along the Proposed Pipeline Route

The proposed pipeline route passes through four vegetation zones, from Boreal Forest in the south to treeless Low Arctic Tundra in the north. These zones are described below and are shown on the accompanying map.

1) **Boreal Forest Zone:** This zone extends from northern Alberta along both sides of the Mackenzie River to Norman Wells. One of the two northernmost extensions of true boreal forest in Canada — the other is along the Yukon River — it owes its existence to the favourable environment in the Mackenzie Valley. Summers are warm and precipitation is moderate. At Fort Simpson average July temperature is 60°F and annual precipitation is 14 inches.

The pattern of vegetation in the Boreal Forest is greatly influenced by fire, a frequent and natural force in this zone. In areas that have not burned recently, black and white spruce are the most abundant trees. Black spruce predominates on poorly drained sites and white spruce on the most favourable sites. Aspen and birch often predominate on exposed well-drained south-facing slopes because these slopes burn more frequently. Evidence of past fires is present in most forests in the form of fire scarred trees, charcoal in the soil, or successional communities of fireweed, shrubs, or aspen.

This zone has relatively well-developed soils, partly because permafrost is sporadic. In the southern half, permafrost is usually restricted to the largely treeless muskegs which are most common south of Fort Simpson. In the northern half of the zone, permafrost is more common under the forest but summer thaw is still deep enough to permit adequate root development to support tree growth.

Some trees are harvested for pulp and lumber in this zone, but slow growth rates lengthen the time it takes for the forests to recover. The best tree growth, especially of white spruce, occurs along major watercourses.

At one time, wood buffalo and woodland caribou were important in the southern and central portions of these forests, along with moose, beaver and muskrat. The latter group still provide the native people with food, clothing, and a means of barter.

2) **Forest-Tundra:** This zone flanks the Boreal Forest and extends along the Mackenzie Valley to north of Inuvik. In the northern Yukon it lies along the Porcupine River. The summer climate is relatively warm and precipitation is lower than in the Boreal Forest. At Inuvik, average July temperature is 56°F and annual precipitation is 10 inches.

Trees are shorter and more widely spaced in this zone as Boreal Forest to the south gives way to Tundra in the north. Black spruce predominate, becoming restricted to sheltered river valleys and warmer south-facing slopes in the northern Yukon, District of Mackenzie and Alaska. Succession and fire relations are similar to the Boreal Forest, with fireweed playing a colourful and important role.

It is within this zone that barren-ground caribou usually overwinter, feeding on lichens, low shrubs, and sedges. Repeated fire over the centuries has probably led to more open forests with an increase in lichen cover, although lichen re-establishment following fire is slow, often 50 to 100 years.

Settlements are usually located beside major rivers and lakes, where plant cover and wildlife are more plentiful than in the harsher interior. Watercourses also provide major transportation routes.

Mackenzie Delta: The Mackenzie Delta, a 3500 sq. mi. maze of channels, lakes and islands is the northernmost extension of forest in Canada. Forest-Tundra communities dominated by white spruce in the south grade into narrow ribbons of spruce and willow near Richards Island and give way to willow-alder tall shrub communities and tundra communities.

Near Inuvik, the Delta illustrates the moderating influence of watercourses. White spruce up to 50 feet tall and over 300 years of age grow on islands in the Delta, while a few



L.C. Bliss

hundred yards away on the uplands around Inuvik scattered black spruce are only 20 feet tall.

The numerous small lakes and small channels in the Delta are bordered by sedges and other aquatic plants. These provide the food base for large populations of muskrat.

3) **Alpine Tundra Zone:** The vegetation of this zone grows in mountain ranges that border the Alaskan and Yukon coast and the west side of the Mackenzie Delta and Valley. Mountain peaks usually support a mosaic of exposed rock and alpine tundra communities. Some valleys, the upper south slopes, and the entire north flanks of these mountains support a combination of alpine and arctic tundras. Forest-Tundra vegetation extends partly up the mountain slopes, primarily along those that face south.

These mountain valleys and slopes are the prime range of Dall sheep (below). South-facing slopes with their thin snow cover are especially important for winter forage. The mountain slopes also provide denning sites for grizzly bear. The mixture of vegetation supports an abundance of small mammals and provides a variety of roots and berries essential for grizzly bears and ground squirrels to fatten up on before they hibernate.

4) **Low Arctic Tundra Zone:** The treeless Low Arctic Tundra is the least extensive yet perhaps the most important of the major vegetation zones to be crossed by the proposed pipeline. Permafrost is continuous here. The soil contains an abundance of ice-

rich permafrost under an insulating ground cover which is very sensitive to disturbance (fire, construction, winter roads), thus making it susceptible to various types of terrain degradation. This region provides habitat essential to caribou for calving and summer grazing.

The people of the region are the Inuit. A coastal people, they derive much of their food from the sea by hunting seals, walrus and whales. They also depend on waterfowl and caribou, and a smaller but essential component of their diet consists of roots and berries. The Inuit are one of the few people whose diet consists mainly of protein rather than carbohydrate. This is because vegetation provides more forage for animals than it does fruits and roots for man and hence produces more food for human consumption in the form of animal protein than carbohydrate. Because of the climate, domestication and crop production have been insignificant in the north; however, domestication of muskox is being undertaken.

The two most important units in this zone are the Low Shrub-Heath Tundra and the Herbaceous Coastal Tundra.

Low Shrub-Heath-Tundra: This unit occurs

on Richards Island and on the highlands east of the Mackenzie Delta north of Inuvik. Summers are cooler than in the Forest-Tundra and annual precipitation is very low. At Tuktoyaktuk, mean July temperature is 50°F, and annual precipitation is 5 inches with a summer rainfall of only 3 inches.

Plant cover is continuous in this zone and includes numerous mosses and lichens. The better drained slopes and hilltops are covered by low shrubs — willows and birch, and dwarf heath shrubs (blueberry, cranberry, Labrador tea) — up to 2 feet tall. Moist, poorly drained lowlands consist of sedge communities. Watercourses (below) are the most favourable sites and support taller shrubs, alder and willows, 5 to 8 feet tall.

The active layer thaws only 1 to 1.5 feet each summer. This keeps the ground moist, despite the very low rainfall, by restricting drainage. As a result, soils are poorly developed here.

The shrublands of this zone provide excellent nesting habitat for ptarmigan, and such passerines as longspur and snow buntings. Voles, lemmings, and hares also occur here. Better drained soils of eskers and bluffs provide denning sites for ground squirrels, foxes, wolves and grizzly bears.

Herbaceous Coastal Tundra: This unit extends along the Yukon and Alaska Coastal Plain. Summers are the coolest of all the vegetation zones and precipitation is low, as in other tundra areas. At Komakuk Beach, mean July temperature is 45°F and annual precipitation is only 5 inches. The growing season is shortest of all, partly because fogs and lower sun angles reduce the benefits of longer daylight hours.

Wet sedge meadows are common in low-lying flat areas. They generally extend inland 5 to 8 miles in the Yukon but over 50 miles in Alaska. Somewhat better drained and larger areas in the foothills to the south are dominated by cottongrass and dwarf heath shrubs. Numerous streams and major rivers descend from the mountains, cross the Coastal Plain and drain into the Arctic Ocean. Their valleys support taller willows and green alder shrubs.

The Coastal Plain and foothills are the calving grounds and summer range of the Porcupine caribou herd. They are also important fall feeding and staging grounds for snow geese. The British Mountains, Foothills and Coastal Plain are one of the last undisturbed ranges of grizzly bears.



E. Kucera



H. Hernandez

Environment Protection Board

In 1970 the Environment Protection Board began studying effects on the natural environment of construction and operation of a natural gas pipeline through the Yukon and Northwest Territories. The study involves collecting baseline data, incorporating environmental planning into pipeline design, assessing impact, preparing guidelines for education and control of construction personnel and evaluating post-construction activities. The Board, now sponsored by Canadian Arctic Gas Study Limited, is composed of specialists in Arctic research or environmental science.

The Board, an autonomous body, is guided by the following objectives:

- 1) To become sufficiently familiar with arctic ecosystems in the area of pipeline operation to permit estimates of biological costs or benefits of construction and judgments about the potential for widespread damage or major disruption of ecosystems.
- 2) To become sufficiently familiar with biological and physical environments so that pre-construction findings can be used as a basis for post-construction evaluation.
- 3) To make recommendations and conduct briefings so that results of the Board's deliberations can be used for maximum environmental protection.
- 4) To make available results of its studies as a direct contribution toward northern scientific development.

The Board's deliberations are to continue throughout the life of the proposed four-year construction project and for a suitable period during the operational phase.

Members of the Environment Protection Board are: Mr. C.H. Templeton (Chairman), Dr. L.C. Bliss, Dr. M.E. Britton, Mr. D.W. Craik, Mr. E. Gourdeau, Dr. I. McTaggart-Cowan, Dr. S. Thomson, Dr. N.J. Wilimovsky and Mr. R.C. Isaak (Secretary).

Outside specialists are used for specific assignments. Administrative support for the Board is supplied by Interdisciplinary Systems Ltd., 528 St. James Street, Winnipeg, Manitoba.

*Additional copies of this brochure
may be obtained from:*

ENVIRONMENT PROTECTION BOARD
528 St. James Street
Winnipeg, Manitoba, R3G 3J4